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CARE AND MAINTENANCE OF COTTON-GIN SAWS AND RIBS[1]

By CHARLES A. BENNETT, *senior mechanical engineer, Bureau of Agricultural Chemistry and Engineering,* and FRANCIS L. GERDES, *cotton technologist, Agricultural Marketing Service*[2]

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INTRODUCTION

Observations made at 700 commercial ginning establishments in 1929 and 1930 disclosed that, for the South as a whole, over 25 percent of the ginning plants were operating gins with saws in poor to fair condition, and about 15 percent had ginning ribs that were similarly designated. The percentages of worn saws ranged from as high as 40 in the Southeast to over 20 in the west part of the Cotton Belt, and those of defective ribs from about 25 to 10, respectively. The greater percentage of bad saws and ribs in the Southeast is probably due in large part to the fact that the majority of the gins in this region are considerably older than those in the western part of the belt, in which expansion of cotton acreage took place more recently.

These conditions are partly due to the fact that the small income from the ginning business made repairing and conditioning of gin machinery prohibitive in many instances. Instead of sending gin saws to the factory for proper filing and gumming by experts working with special instruments, or purchasing efficient sharpening machines, many ginners feel impelled to attempt to do the sharpen-

[1] The cotton-quality phases of this report are a part of the program of Cotton Quality and Standardization Research under the leadership of R. W. Webb, principal cotton technologist, Agricultural Marketing Service.

[2] Acknowledgments are made to Anderson, Clayton & Co., CenTennial Cotton Gin Co., Continental Gin Co., Creasy Rotary Filer Co., Gullett Gin Co., Hardwicke Etter Co., Lummus Cotton Gin Co., The Murray Co., Riechman-Crosby Co., San Antonio Machine & Supply Co., Jno. R. Smith & Sons, Smith-Newman Co., Southwestern Gin Machinery Co., The A. A. Wood & Sons Co., and others for their cooperation in supplying some of the information contained in this circular; to those staff members of the Agricultural Marketing Service and the Bureau of Agricultural Chemistry and Engineering who assisted in the work; and the Grade and Staples Estimates project for collecting the data relative to gin-saw and gin-rib conditions of commercial gins.

ing themselves with little information and with inadequate equipment, or are forced to forego such repairs altogether. Transient saw filers have also had to do cheaper work because of the financial status of the ginner. Moreover, large plantation owners often leave such duties to an unskilled worker unable to do the work properly.

This circular emphasizes the importance of keeping gin saws and ribs in good condition and gives practical information regarding their maintenance and repair.

EXPERIMENTS WITH NEW AND WORN GIN SAWS

In order to determine the effects of saw condition on the monetary value of the lint and on some mechanical phases of gin operation, a series of ginning tests was conducted with a set of gin saws classified as in good condition and another set as in poor condition. Figure 1 portrays typical examples of saws classified in this manner.

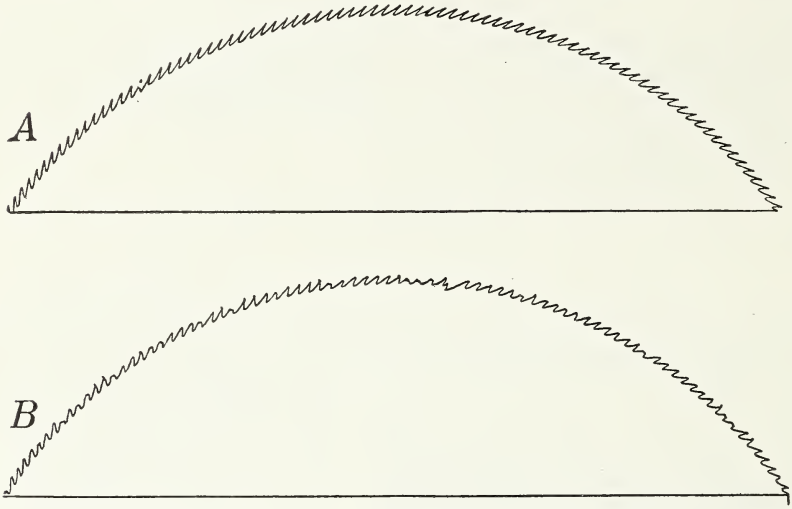

FIGURE 1.—Segments of cotton gin saws, *A* in good condition and *B* in poor condition. (Accurately traced from photographs of saws as used.)

For the experiments, a 70-saw double-rib huller brush gin containing 12-inch diameter saws was used, and was operated with loose and tight seed rolls at the manufacturer's recommended gin-saw speed. The cottons used were all upland varieties, grown in the States of Alabama, Arkansas, Louisiana, and Mississippi, as indicated in table 1. In addition to the identification of each of these cottons, several elements of quality, as determined by laboratory methods and cotton classer's appraisal, are also shown. These cottons cover a wide range in grade, thus giving a reliable account of the effects of gin-saw conditions on several grades, rather than on only one or two grades as would at first seem to be the case from the average grade figures shown in this report. The cottons were grouped into length groups of 1⅛ inches and longer, and shorter than 1⅛ inches, four cottons making up the longer length group, and eight cottons comprising the shorter length group. All cottons within each group were averaged in compiling the results presented herewith.

TABLE 1.—*Cottons used in gin-saw tests*

Identification of cotton		Variety	Place of growth	Harvesting		Moisture content of seed cotton [1]	Laboratory determinations [2]					Cotton classer's appraisals	
Length group (inches)	Lot No.			Date	Stage		Weight of 100 seed	Weight of lint from 100 seed	Proportion of lint	Upper quartile fiber length [3]	Variability of fiber length [4]	Staple length [5]	Grade [5]
						Percent	*Grams*	*Grams*	*Percent*	*Inches*	*Percent*	*Inches*	
1⅛ and longer.	341	Stoneville No. 2A	Stoneville, Miss.	Sept. 28	Second	12.7	11.993	5.608	31.9	1.110	74.4	1 3/32	M., B
	344	Wilds No. 5	Australia Island, La.	Sept. 15	First	12.5	12.923	5.807	31.0	1.356	53.9	1 9/32	S. M., B.
	372	Missdel No. 3	Stoneville, Miss.	Oct. 17	do	12.0	13.146	5.605	29.9	1.266	50.1	1⅛	S. L. M., B.
	389	do	do	Oct. 30–31	Second	11.5	12.607	5.259	29.4	1.267	76.7	1⅛	L. M., B.
Shorter than 1⅛.	334	Stoneville No. 3	Hollyknowe, Miss.	Sept. 21, 24, 25	do	11.6	10.644	5.239	33.0	1.060	71.7	1 1/16	S. M. sp. [6]
	335	do	Stoneville, Miss.	Sept. 24–27	Third	10.5	10.325	4.889	32.1	1.015	77.0	1 1/16	S. L. M
	356	Dixie Triumph	Baton Rouge, La.	Sept. 15	First	11.4	10.083	4.755	32.0	.969	66.1	31/32	S. M. sp. [6]
	361	D. P. L. No. 10	Brooksville, Miss.	Oct. 8	Second	11.3	10.052	5.972	37.3	.990	68.5	1	S. M.
	365	Stoneville No. 2A	Stoneville, Miss.	Oct. 10–11	Second and third.	9.3	10.799	5.199	32.5	1.064	56.8	1 1/16	L. M.
	381	Rowden No. 40	Montrose, Ark.	Oct. 25	Second	9.1	11.771	5.713	32.7	.963	79.4	31/32	S. L. M.
	388	Wilson Type	Wilson, Ark.	Oct. 26	do	11.0	11.142	5.257	32.1	.874	71.0	29/32	L. M.
	398	Cook 307	Prattville, Ala.	Aug. 25	First	9.4	10.304	6.058	37.0	.916	71.7	29/32	M.

[1] As determined by oven tests.
[2] Lint hand-pulled from seed.
[3] Length of the fibers at the 25-percent point on the length-cumulative weight percentage curve beginning with the longest fibers.
[4] Difference between fiber lengths at 90- and at 10-percent points on the length-cumulative weight percentage curve divided by the length at the 50-percent point, times 100.
[5] Lint samples ginned with good saws and a loose seed roll at the manufacturer's recommended gin-saw speed.
[6] Abbreviation sp. is for spotted.

Engineering observations and records were made, appropriate samples were drawn at the condenser during each test and classed by a Government classer, and the data were analyzed statistically.[3]

EFFECTS OF GIN-SAW CONDITION ON THE MONETARY VALUE OF THE LINT

For the purpose of indicating the effects of gin-saw condition on the monetary value of the lint ginned from 1,500 pounds of seed cotton, and to set forth the factors governing such value, table 2, embodying data obtained from the previously described tests with 12 cottons, was prepared. Four factors must be considered in determining the bale value; namely, grade, staple, base price per pound of lint, and weight of the bale or the turn-out per 1,500 pounds of seed cotton.[4]

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[3] The average grade, both for cottons 1⅛ inches and longer and for cottons shorter than 1⅛ inches, was determined by adding together the numerical values of color, leaf, and preparation, and dividing this by three times the number of samples. Staple length was designated in intervals of one thirty-second inch and converted into decimals for averaging, and the final average staple length of a group of samples was converted from the code or decimal value to a fractional value.

[4] The prices indicated were calculated from data on file in the Division of Cotton Marketing, Bureau of Agricultural Economics, relating to the approximate average price per pound of cotton of specified white grades and staple lengths prevailing at Memphis, Tenn., for the season of 1933–34. Bale weights were calculated by applying the average turn-out percentage of lint of the several cottons in each group to 1,500 pounds of seed cotton, and adding 22 pounds for bagging and ties.

TABLE 2.—*Average effect of gin-saw condition on the monetary value of ginned lint* [1]

Seed-cotton length group [2] (inches)	Seed cottons [2]				Condition of gin saws	Loose seed roll					Tight seed roll				
	Staple length		Moisture content			Grade [3]	Staple length	Price per pound [4]	Weight of bale [5]	Value of bale	Grade [3]	Staple length	Price per pound [4]	Weight of bale [5]	Value of bale
	Range	Average	Range	Average											
	Inches	*Inches*	*Percent*	*Percent*		*Index*	*1/32 inch*	*Cents*	*Pounds*	*Dollars*	*Index*	*1/32 inch*	*Cents*	*Pounds*	*Dollars*
1 1/8 and longer	1 1/8–1 9/32	1 3/16	11.5–12.7	12.2	Good	5.42	37.50	12.83	448	57.48	6.25	37.50	11.97	452	54.10
					Worn	5.58	37.50	12.64	438	55.36	6.33	37.25	11.78	440	51.83
Shorter than 1 1/8	29/32–1 1/16	1	9.1–11.6	10.4	Good	5.33	31.74	11.27	491	55.34	5.75	31.23	10.94	486	53.17
					Worn	5.38	31.74	11.25	484	54.45	5.92	31.23	10.88	475	51.68

[1] Ginning was performed with a double-rib huller brush-type gin, having 70 saws of 12 inches diameter, operating at a speed of 500 revolutions per minute.
[2] See table 1 for identification and description of these cottons.
[3] The indices used for grade designation are 5 for Middling and 6 for Strict Low Middling, with the decimals denoting proportionate fractions of grades.
[4] Calculated from approximate average prices per pound for cotton of specified white grades and staple lengths prevailing at Memphis, Tenn., for the season 1933–34.
[5] Calculated by applying the turn-out percentage of lint to 1,500 pounds of seed cotton and adding 22 pounds for bagging and ties.

Referring to table 2, it is noted that in the tests employing cottons 1⅛ inches and longer in length, the value of the lint produced by the good saws exceeded that of the lint obtained from the worn saws by amounts well over $2 per bale. When cottons shorter than 1⅛ inches were used, this difference in bale value was not so great, but still showed consistent margins, favoring the good saws, averaging about $1 per bale.

In analyzing these differences to determine the causes, it may be noted that the increases in value resulting from the good saws are due principally to the increased lint turn-out produced by them, over that obtained from the worn saws. The average difference in bale weight in favor of the good saws was about 10 pounds.

Price differences are of less importance but are greater with the longer length group than with the shorter length group of cottons, not only because of the relatively wider range of premium and discount differences in the case of the longer cotton but also for the reason that the quality benefits indicated for the good saws are slightly more with the longer cottons.

To illustrate some of the quality benefits derived from the use of good saws in the tests described, figure 2 is presented.

EFFECTS OF GIN-SAW CONDITION ON MECHANICAL PHASES OF GINNING

Gin saws in good condition also provide some important advantages over badly worn or poor saws with respect to certain mechanical phases of gin operation, as shown in table 3. This table indicates the ginning time, the power requirements, and the energy consumption of the same samples presented in table 2.

TABLE 3.—*Average effects of gin-saw condition on certain mechanical phases of ginning 1,500 pounds of seed cotton* [1]

Seed-cotton length group [2] (inches)	Condition of gin saws	Loose seed roll			Tight seed roll		
		Ginning time	Power requirements [3]	Energy consumed [3]	Ginning time	Power requirements [3]	Energy consumed [3]
		Minutes	*Horsepower*	*Horsepower-hours*	*Minutes*	*Horsepower*	*Horsepower-hours*
1⅛ and longer	Good	52.9	10.6	9.3	37.5	17.5	10.9
	Worn	71.2	10.2	12.1	44.2	16.4	12.1
Shorter than 1⅛	Good	59.3	10.3	10.2	43.1	15.4	11.1
	Worn	69.6	9.6	11.1	51.0	14.4	12.2

[1] Ginning was performed with a double-rib huller brush gin having 70 saws of 12 inches diameter and operated at the manufacturer's recommended speed.

[2] See table 1 for identification and description of the cottons used in these tests, and table 2 for the ranges covered by them.

[3] For feeder, brush, and gin saws.

The greatest operating advantage of the use of good saws over that of bad saws is the saving in time required to gin equal amounts of seed cotton. The ginning time required was approximately 30 percent more for the bad than for the good saws, with the longer staple cottons, and about 20 percent more with the shorter staple cottons.

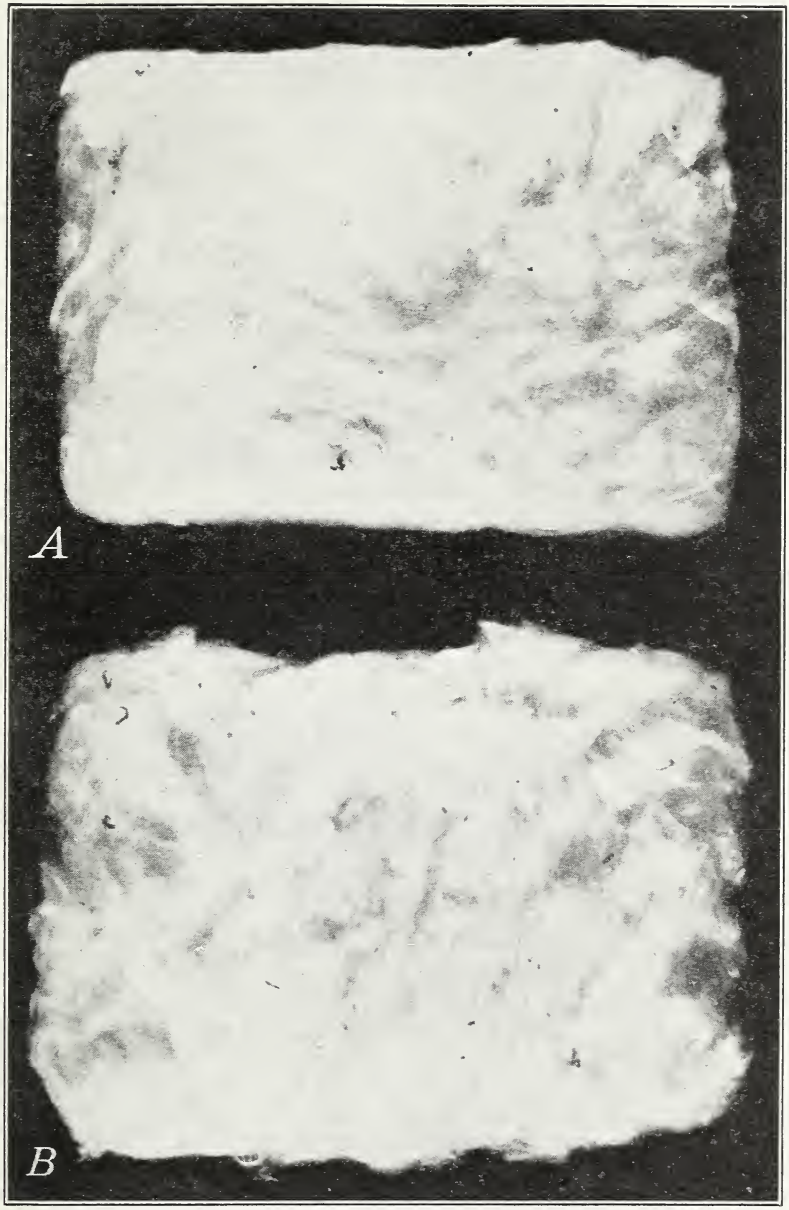

FIGURE 2.—Samples of lint ginned from the same seed cotton: *A*, With saws in good condition; *B*, with saws in poor condition.

With respect to power requirements, gin-saw condition had little effect, showing a slight tendency to be lower for the bad than for the good saws. The fact that the poor saws were not performing their full duty in grasping as many fibers as the good saws, and were thus reducing slightly the pull or load on the saws, would tend to explain this lowering of power requirements in the case of the worn saws.

Energy consumed by the gin stand and feeder per bale, was slightly higher throughout the series of tests in which the poor saws were used. Since this factor is determined by the power requirement and the time taken to gin a bale of cotton, the increase in time of the bad saws over the ones in good condition is sufficient to offset the difference in power required and give a marked increase in the energy consumed. Although no figures are presented on energy consumption of auxiliary machinery such as fans, cleaners, and distributors, these would necessarily be running longer when ginning with worn saws and consequently add to the power cost per bale.

The slight decrease of power requirements for the bad saws, accompanied by a raising of total energy consumed, indicates that one of the most beneficial results to be obtained from the use of good saws is that of saving or gaining in time together with the consequent increase of capacity at an equal or lower total power cost.

CONSTRUCTION AND RECONDITIONING OF GIN SAWS

GIN-SAW CONSTRUCTION

Gin saws are usually 10 or 12 inches in diameter, the smaller size being used principally in plain gins, whereas huller front gins employ the larger saws. Standard practice is to provide from 235 to 255 teeth per 10-inch and 264 to 282 teeth per 12-inch saw.

A number of trade names or terms pertaining to various features of saws and assemblies have been used for many years, and before discussing gin-saw teeth, it seems desirable to define some of these. "Fineness" refers to the equivalent number of teeth per 12-inch saw; "pitch", to the slope of the leading edge of the tooth; "pitch angle", to the number of degrees in the acute angle made by the radius of the saw circle and the leading edge of the tooth at its tip (fig. 3); "roach" and "straight", to the shape of the trailing edge or back of the tooth; "round-back" or "pyramid" or "octagon", to the manner in which the backs of the teeth are finished; "bore", to the hole in the saws and the diameter of the shaft or mandrel upon which they are assembled; "spacer", to the spacing blocks which separate the saws; and "cylinder", to the completed working assembly of shaft, spacers, and saws. "Gumming" is that part of the sharpening process having to do with shaping and deepening the notch between adjacent saw teeth.

Figure 3 shows some of the distinguishing features of present-day gin-saw teeth. The straight tooth, *A*, *a*, appears to have been universally used until the advent of the double-rib huller gin in 1889, since which time roach teeth [5] (fig. 3 *A*, *b*, and *c*) have been gradu-

[5] From information supplied by Daniel Pratt, roach teeth were introduced by Jonathan T. Turner's Sons Co., of Sing Sing, N. Y., in 1889, when this firm is said to have been supplying many of the gin saws used.

ally brought into use. This may have been due to a belief that the roach teeth are stronger and more suitable for huller gins. In the plain gins the only function of the teeth is to remove the fiber from the seed, but in huller gins the teeth also convey the locks of seed cotton from the outer breast into the seed roll. The heavy roach teeth have gone out of use, although some ginners still favor the modified form.

An enlarged diagram of the two kinds of tooth sharpening is also given in figure 3, *B*, in which the range of stock thicknesses and tapers is shown. Although only straight teeth are shown in this enlargement, roach teeth are similarly sharpened.

The following discussion of gin-saw teeth is based on experience and tests involving only present standards of saw spacing, i. e., approximately three-fourths of an inch on centers. In the Southeastern States of the cotton-growing regions, a commonly used shape of tooth is the octagon tooth because it has rounded corners on both the leading and back edges. Such a tooth, though preferred by some

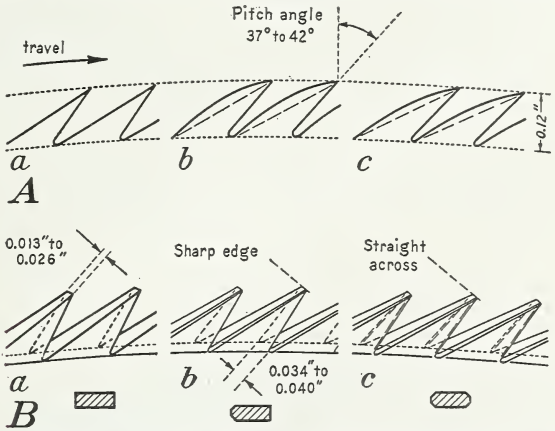

FIGURE 3.—General features of gin-saw teeth: *A*, Shapes of teeth; *a*, straight; *b*, heavy roach; *c*, modified roach. *B*, Methods of sharpening straight teeth; *a*, leading and back edges angular; *b*, back edges rounded; *c*, both edges rounded.

ginners, is not deemed to be superior in any respect to the standard round-back tooth.

The leading edge of any gin-saw tooth should be straight across and at right angles to the saw disk, without having corners so sharp as to cut. The front corners of each tooth should have no "wire edges" or metal burs left from gumming or punching, and the corners on the back of the tooth should also be free from any roughness which would tend to catch or hold the fibers. To remove such roughness and procure smooth teeth, some shops revolve the saw cylinder backward in a box containing fine sand or emery dust.

The extreme tip of the teeth should not be brought to a needle-point sharpness, because such a tip will tend to bend or wear down quickly. Consequently it is good practice to leave a sharp tip without a blunt top, somewhat as indicated in figure 3 for straight teeth. The side taper given the teeth should not bring them to a point at the tip, but rather should only reduce the thickness of the tooth enough to gin satisfactorily. Different manufacturers dress

the sides of the teeth to different tapers, largely dependent upon what section of the country is to be served. Thus the teeth for ginning snapped and sledded cottons would be left as thick as possible at the tip, generally as much as two-thirds of the saw-disk thickness or 0.026 inch, while saws for hand-picked cottons of the Southeastern States have been dressed down at the tips to 0.013 inch. In general, the best practice is now deemed to be that which takes off only enough metal on the tapering sides of the teeth to remove the rough edges and metal burs left from sharpening.

The throats of the teeth should not be sharp, but rather rounded or square without roughness. This is well taken care of in the forms of gummer files sold for the various brands of machines now in use. Except when sticky or damp seed cotton is being ginned, it is doubtful whether the fibers ride down into the throats of the teeth, so avoidance of a sharp throat is all that is required from a practical standpoint.

GUMMING AND FILING

The importance of having saws in good condition by maintaining as nearly as practicable the factory pitch, shape, and length of teeth has already been pointed out. It is of the utmost importance that decrease in factory pitch be prevented, since decreasing the pitch adversely affects the lint turn-out and ginning capacity. Regular inspection of the saw teeth should be carried on, and irregularities and damage should be repaired as soon as possible. In figure 1, *A*, is shown a segment of a saw disk direct from the factory and it should be the aim of every ginner to have his saws match as nearly as possible the excellent condition of this saw. When the saws become damaged or worn so that they cease to resemble the factory condition, they should be sharpened. When ginning roughly harvested cottons much more frequent sharpening is required than is needed with the ginning of clean, hand-picked cottons. That is, the rougher the cotton the greater is the damage done to the saw teeth during ginning. Also too much moisture in the cotton contributes to wear and tear of saw teeth.

A ginner may keep his gin saws in good condition by shipping the saw cylinders back to the factory for a thorough and complete reconditioning, by employing transient saw filers, or by purchasing saw-filing machines for use by his own workmen. The manufacturers of some makes of gins instruct their patrons that only by factory sharpening can the performance of their equipment be guaranteed. When the saws are not returned to the manufacturer, care should be taken that the work is done in accordance with instructions of the manufacturer of the sharpening machine to be used.

The machines on the market for sharpening gin saws at the gin include both portable and semiportable types (figs. 4 to 7). The portable machines are operated either by hand or by motor, while the semiportable machines are mostly motor-driven.

The portable machines are designed to permit sharpening the saw cylinder in place, and, consequently, do not require removal of the cylinder from the gin stand. Semiportable machines, however, require the cylinders to be removed from the gin stand and set into

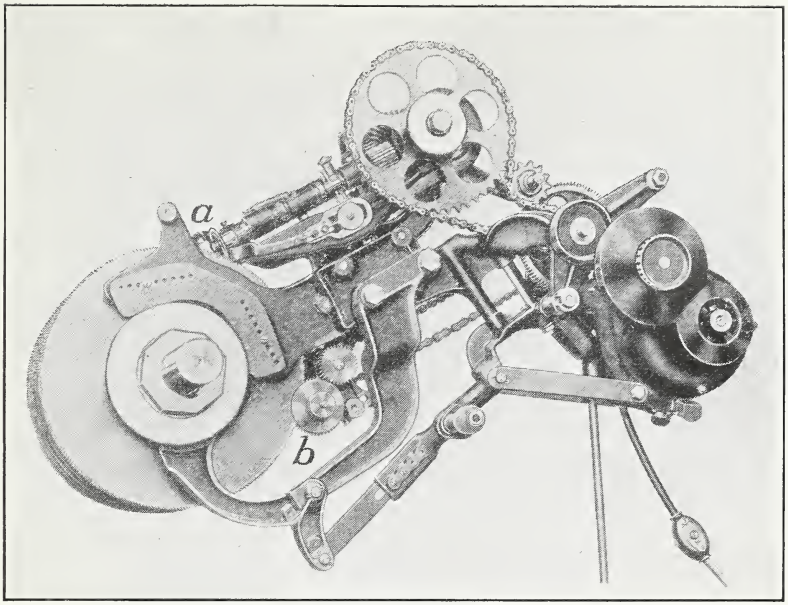

FIGURE 4.—A portable duplex, motor-driven filing-gumming machine having both rotary gummers, *a*, and rotary side files, *b*; also made for using angular side files.

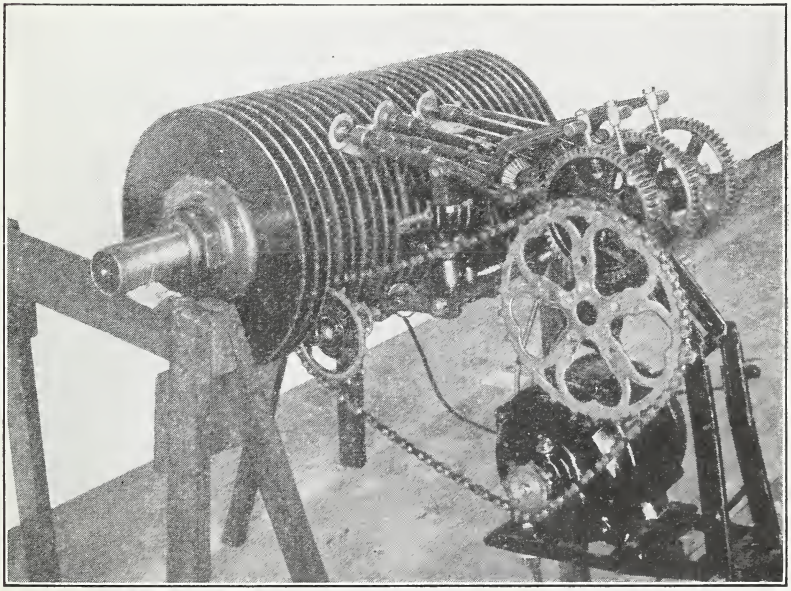

FIGURE 5.—A portable triplex, motor-driven filing-gumming machine having rotary gummers and rotary side files; also made for using angular side files.

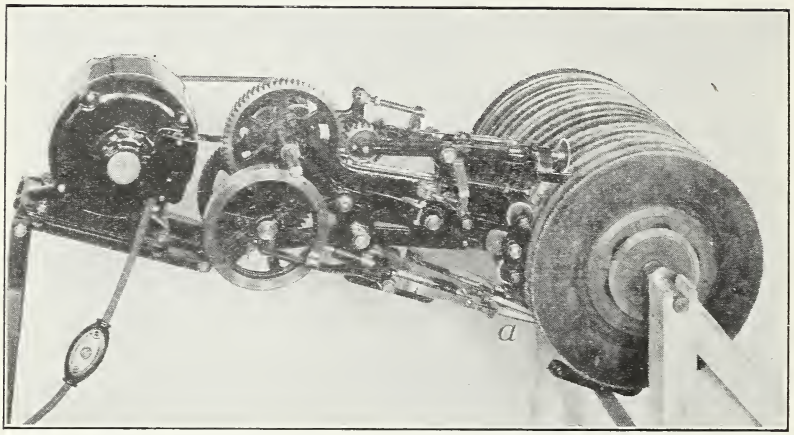

FIGURE 6.—A portable motor-driven multifiler having rotary gummers, using both rotary and angular files, *a*, simultaneously for side filing.

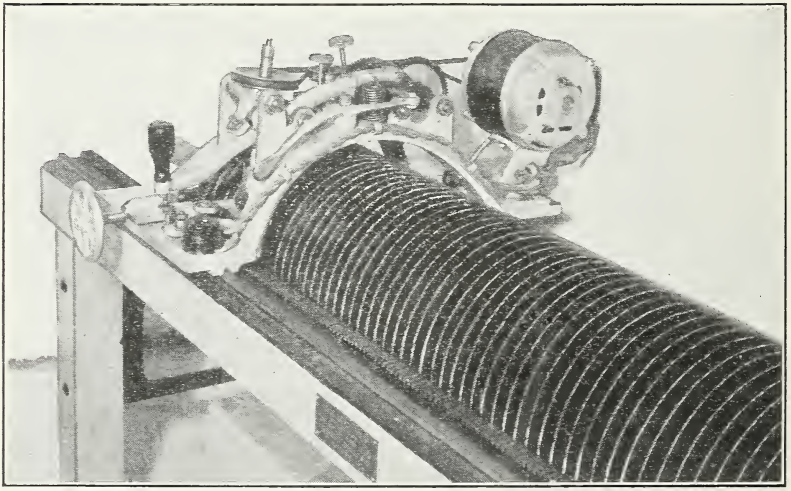

FIGURE 7.—A semiportable motor-driven filing machine with rotary gummers only, the side dressing being accomplished by hand with a special flat mill file.

a sharpening frame. The latter machines accordingly find especial application in large gins and oil mills where spare cylinders are kept on hand, and where linter cylinders require frequent sharpening. Both types are used satisfactorily, and have many individual features of merit. During the past 10 years sharpening machines have been developed that eliminate the tedious adjustment which was the principal objection to outfits sold previously.

Reference to the pictures of the various machines shows that gumming and filing of the teeth ordinarily is accomplished in the same operation; and that the gumming procedure, employing rotary gummers, is substantially the same with all machines. However, the filing action is brought about either by the use of rotary side files or angular files, depending on the type of machine used.

In reconditioning saws with the machines shown in figures 4, 5, and 6, the gumming operation is usually done first, except for a small portion of the saw, after which the angular files remove the burs and finish the teeth. Where two or more saws are handled by the machine, the gumming may be done on one saw and the filing upon the following one. In filing, the sides of the teeth may be dressed with either rotary side files or angular files. Figure 8 shows

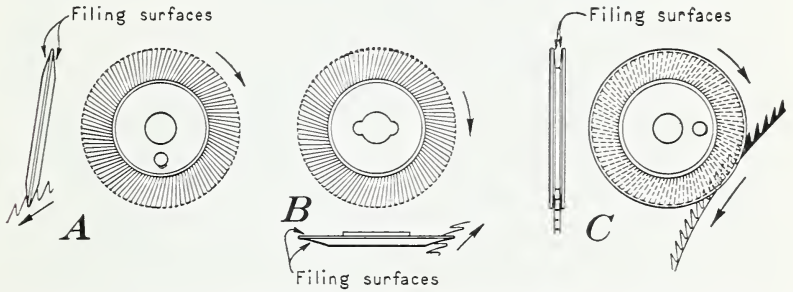

FIGURE 8.—*A* and *B*, Gummers for sharpening the leading edges of teeth; *C*, rotary side files for dressing the teeth on both sides after the edges have been sharpened.

views of gummers in position while sharpening straight and roach teeth, and rotary side files for dressing the teeth on each side.

The gummers work some distance in advance of the rotary side files and care should be taken to stop the gummers after they have completed the circle. With some machines the gummers will file too deep a notch if passed over the teeth a second time. In sharpening saws with the machine illustrated by figure 7, gumming is first performed and then the teeth are side dressed with a flat hand file, after which the cylinder may be run backwards in a sand box, accomplishing what is usually equivalent to a three-stage sharpening where a round-back tooth is desired.

In addition to gumming and side dressing, sometimes angling or corner filing is done to finish the tooth, in lieu of the sand-box method of rounding off these back corners which has already been described. For short-staple, hand-picked cottons or for roughly harvested cottons of any staple length, a two-stage sharpening which produces a pyramid tooth is usually sufficient; but for clean, hand-picked seed cottons of the longer-staple lengths with prime qualities, the three-stage sharpening is preferable. For the average

gin, however, it is advisable that these three distinct filing operations should be performed on each saw because the gumming forms the tooth and deepens the throat, the flat side filing points the tooth so that it takes the fiber of the cotton readily, and the angling filing or sand-box finish removes the acute angles from the corners of the teeth together with any burs that previous filings may have left on the sides of the teeth.

It is of great importance that the angular files, in any of the types of machines illustrated, be used intelligently to prevent tooth damages which may result from improper adjustment of the files. The corner filing must not be allowed to produce either sharp throats or needle points. To guard against such adverse results, the portable machines must be correctly adjusted, and must not be operated upon rough or irregular gin floors, which frequently may pass on such irregularities to the saw teeth by throwing the files out of adjustment.

The use of oil is usually recommended for new gummers and files, and this should preferably be of a type known as cutting oil, such as lard oil or special compounds prepared for that purpose. Pure lard oil may be diluted to a half-and-half mixture with filtered automobile crankcase drainage if a large amount of sharpening is to be done.

When the saw sharpening and repairing is to be done at the cotton gin, the first item required is either a sample factory saw, a template, or a factory gage showing the correct pitch of the teeth. These may be obtained from the makers of the gin stands. To determine whether the shape of the saw tooth accurately matches the factory pitch, it is necessary to remove from the mandrel the first saw sharpened and lay it flat upon the factory sample so that the teeth may be examined entirely around the circle. Before attempting to sharpen the saws, it is also necessary to find out whether the saw disks are circular and of the correct diameter. If a 12-inch saw has been worn down so that it is out of round, or if it has ginned many bales and has been resharpened so many times as to be reduced to $11\frac{15}{16}$ inches in diameter, then a new saw is needed because the original saw and rib relationship will have been destroyed. Many ginners buy new saws when their old saws have worn down to $11\frac{7}{8}$ inches in diameter.

If the saws are suitable for further use, all bent teeth must be straightened before any sharpening is undertaken. Factory experts and experienced gin men frequently check the pitch of saw teeth to insure that the leading edges pass through the ribs parallel with the rib surface, or preferably with the point entering the ribs barely ahead of the throat of the tooth. This check may be made by scribing a line onto the saw from the rib, or by placing a sheet of writing paper between the saw teeth as they are about to pass through the ribs. By turning the saw cylinder gently against the paper, the teeth tips will mark the paper without cutting through. These tip marks should be a row of light impressions or dots if the pitch is factory standard. The teeth will either tear or shear the lower edge of the paper if they have insufficient pitch. Although an increased pitch beyond standard is seldom encountered in resharpened saws it is preferable to a decreased pitch if it does not weaken the teeth.

Repeated sharpening of the gin saws may in time cause them to become warped and wabbly at the rim, thereby leading to serious fire hazard and interfering with proper ginning when the saws rub or strike against the gin ribs. To remedy this, such saws must be trained into the centers of their rib slots. This may be accomplished with a hand training tool which is usually a form of slotted steel bar, or with a machine having rollers or other means for stretching and straightening gin saws. Novices should not attempt to train gin saws.

A machine for training gin saws is shown in figure 9. From one to three revolutions of the saw usually give sufficient rolling to tighten a loose rim or buckled saw. The machine, when correctly adjusted, places the rolls at approximately 1¼ inches in from the

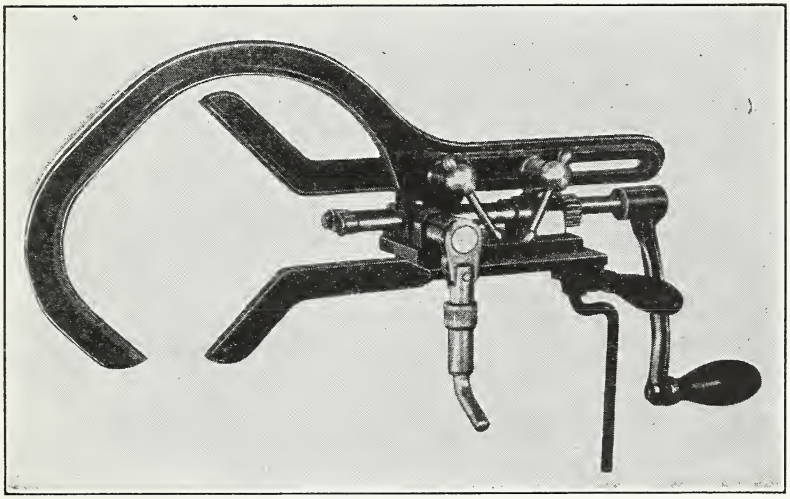

FIGURE 9.—Roller device for straightening gin and linter saws used in cotton gins and cotton-oil mills.

edge of the saw, after the fork and hook members of the machine have enclosed the space blocks of the cylinder to circumscribe the action of the rolls about the center of rotation.

The "breaking-in" to polish the points of newly sharpened gin saws should be done with loose seed rolls. The practice of putting sand into the seed roll to hasten this process should never be followed; it injures both the points and the leading edges and cannot help the saws in any manner. In the sand-box method used by gin-saw manufacturers the saws revolve backward, and the teeth are not damaged.

CARE OF GIN SAWS DURING THE IDLE SEASON

Rust and corrosion are, of course, the greatest enemies to the life of any metal machinery when standing idle, and gin saws are no exception. Gin saws can be well protected at the close of the ginning season by covering them with a coating of crude oil or some other oil which will leave a protective film for an indefinite period. At the beginning of the next ginning season, this protective covering can be removed with cloth soaked in kerosene or white gasoline, with no

damage to the gin saws. Saw cylinders must not be left in contact with a seed roll which may become damp or rotten during the idle season. Where gin saws are housed in defective buildings and unsheltered from dampness through the long idle season some ginners soften the rust with kerosene and then depend on its removal by the ginning of the first few bales of cotton. Aside from the obvious unfairness of this practice to the customer, it is also harmful to the saws.

ADJUSTMENT AND REPAIR OF GIN RIBS

FUNCTIONS OF GINNING RIBS

Ginning ribs should have careful attention because they must maintain certain essential relations with the saws in order to achieve smooth and satisfactory ginning.

The purpose of a gin-rib assembly is to enable the saws to convey the fibers from the roll box without permitting seed to accompany them through the ribs. Spinning-mill difficulties develop if seed are allowed to pass through the ribs with the lint. Also, if seed are present in the bale, quarantine regulations require that the cotton be sterilized as an insect-control measure.

The ginning industry has recognized for many years the importance of correct shapes of the gin rib and a necessity for clean, well-defined edges on the roll-box face of the rib. The ribs must offer no resistance to the rotation of the seed roll and should be so constructed that fiber or seed cotton will not become lodged in the interstices above the saws.

Ribs are usually made of cast iron, the roll-box faces of which become highly polished during the ginning season. The polish is valuable in assisting the seed roll to rotate freely without the fiber being damaged by the rubbing and pressure of the seed roll.

RIB SPACING AND SAW POSITION

Experience has taught most ginners that rib spacing and saw position are of vital importance to good ginning. Factory assemblies of ribs may differ in shape and in various constructional features, but the spaces between the ribs where the teeth pass out—the saw slots—are almost universally maintained at approximately 0.116 to 0.120 inch, or about three saw thicknesses. If this spacing is increased beyond $^{9}/_{64}$ inch either by wear, faulty repairing, or replacement, some seed will pass through the rib space along with the lint and cause a very undesirable addition of seed to the ginned lint. Under such conditions chokages and fire hazard also often result.

The saws should revolve in a central position between each pair of ribs, and adjusting bolts should allow no end play. Saws should not be allowed to rub against the ribs, not only because of increased wear and tear to saws and ribs, but also because of damage to the lint and because danger of fires results.

The tips of the teeth on the upper edges of the saws should be located at the factory setting or distance measured from the upper offset (or from the upper rib rail) of the ginning ribs. This distance varies with the make and model of the gin stand. Such information should be obtained from the manufacturer.

Protrusion of the saws through ginning and huller ribs should also correspond to factory settings. These settings to some extent are dependent upon the staple length and other characteristics of the seed cottons to be ginned. Figure 10 shows the principal rib settings, which should be made to correspond with factory practice.

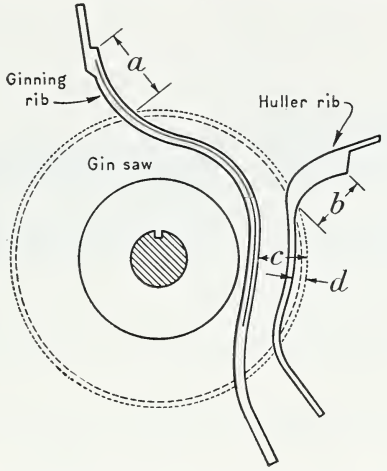

FIGURE 10.—Dimensions to be checked in obtaining correct gin-rib settings: *a*, ginning-rib offset; *b*, huller-rib offset; *c*, ginning-rib protrusion; *d*, huller-rib protrusion.

All rib assemblies should be inspected regularly as to surface alignments, loose screws, broken ribs, and condition of adjusting bolts.

REPAIRING GIN RIBS

When ribs are broken, they should be removed and replaced with new ones. When ribs are worn so that seed may get through or so that the places where saws pass out of the roll box are distorted, grooved, or otherwise unsuitable for good ginning, any one of the following steps may be taken to correct the trouble: (1) New rib assemblies may be obtained from the factory; (2) new ribs may be purchased and assemblies made at the gin; (3) the rib assemblies may be shipped to repairing agencies; or (4) the ribs alone may be so shipped and then reassembled at the gin after repair.

When new ribs are purchased to replace damaged ribs, care should be taken to see that the new ribs are for the particular make and model of gin to be repaired.

Where assemblies are sent to shops for repair, or new assemblies are purchased, a soft pine template, carefully marked to show right and left ends and saw spacings, should be made up to accompany the shipment. This may be marked clearly by turning the saws backward against the edge of the template.

Repairs to gin ribs consist of: (1) Inserting new segments into a cutaway socket in the rib; (2) welding new material upon the worn spots to build up the rib, followed by grinding to correct dimension and shape; or (3) covering the worn surfaces with hardened plates of suitable width and minimum thickness to once more give well-defined edges to the ribs.

Figure 11 illustrates method (1), or ribs repaired by welding processes, one of the most recent developments in rib repairing. This method of repair is usually done by arc welding, using a special steel which is much harder and tougher than the original cast iron

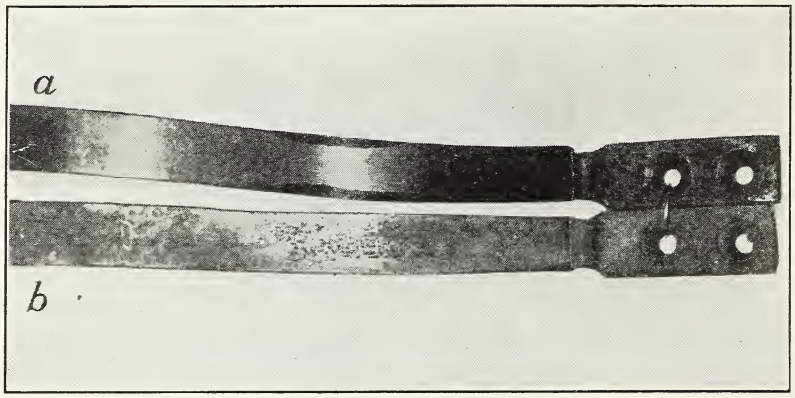

FIGURE 11.—Ribs repaired by welding new metal upon worn places, and then grinding to factory dimensions with mechanical gages and accurate fixtures: *a*, Rib built up and ground; *b*, plated and finished rib.

of the rib. The ribs should then be ground to accurate dimensions. Welding and hand grinding by itinerants without suitable equipment is not recommended because it seldom insures uniformity and

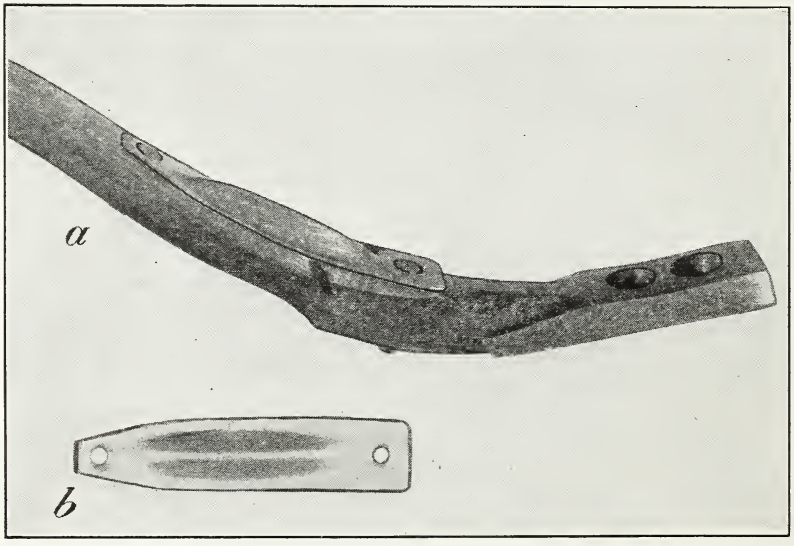

FIGURE 12.—Rib repaired (*a*) riveting hardened plate (*b*) over worn place. (Worn spot shaded for emphasis.)

is decidedly inferior to the work of a well-equipped shop. The better equipped rib-repairing shops and the manufacturers of ginning machinery now place a final nonrusting finish of cadmium plating upon both repaired and new ribs by electrolytic methods.

Figure 12 is an example of rib repairing described in method (3), and is accomplished by means of thin metallic plates riveted to the ribs at the place of wear. To obtain satisfactory results with this method of repair, a shop must be equipped with gages, jigs, and other means for precision work. The repair segment is usually made of thin steel, casehardened and cadmium-plated to resist corrosion, although brass plates have been used.

CARE OF GIN RIBS DURING THE IDLE SEASON

Preservation of the polished surfaces and edges of gin ribs is very desirable, and a coating of oil similar to that used for protecting gin-saw cylinders at the close of the ginning season may be used.

Before coating the ribs, however, it is an excellent practice to varnish or paint the wooden rib rails to which the ribs are attached. This will prevent rotting or cracking, and will keep moisture or grease from entering the wood. Spar varnish is considered by many to be the best coating for wooden parts of rib assemblies, but shellac also is excellent.

If, for any reason, rib assemblies are removed from gin stands during idle seasons, they should be racked or supported in such a manner that the wooden parts will not become warped or distorted. On the other hand, if the rib assemblies are left in the gin stands, the roll boxes should be thoroughly cleaned after dumping all seed, and the breasts should be down in ginning position. Gin stands should not be left with the breasts raised during the idle season, because that keeps the entire assembly and springs under strain.

CONCLUSIONS AND RECOMMENDATIONS

Comparison of the results of ginning tests with gin saws in good and in poor condition showed an average difference in the monetary value of the lint of more than $2 per bale with cotton 1⅛ inches and longer, and of about $1 per bale with cotton shorter than 1⅛ inches staple length. The greatest factor in raising the value of the bale was the greater lint turn-out with the good saws. The saws in good condition ginned the seed closer than the worn saws, resulting in an average difference for all cottons and conditions employed in this study of about 10 pounds of lint per 1,500 pounds of seed cotton. The second factor was the enhancement in grade. Increase in staple length was of only minor importance.

Using saws in poor condition as compared to the saws in good condition increased the time of ginning about 30 percent with the longer and about 20 percent with the shorter staple cottons. Although the power requirement was slightly less with worn saws, the energy consumption was equal or greater because of the added ginning time.

Proper attention by the ginner to the sharpening of gin saws should result in increased profit through the longer life of machinery, should enhance the value of the cotton, and provide better ginning service. Whether the saw cylinders are sent to the factory or the reconditioning is done by a transient saw filer or by the ginner himself, the instructions of the manufacturers of sharpening ma-

chinery should be carefully followed in reconditioning gin saws and the machine for this work should be so operated that factory pitch, shape, and length of the saw teeth are maintained so far as is practicable. Tests at the U. S. Cotton Ginning Laboratories have indicated that angular side files, when properly used, generally appear to produce slightly better results than rotary side files.

Sharpening procedure with some machines comprises only a two-stage gumming and side dressing; while with others it is a three-stage gumming, side-dressing, and filing or sand-box operation. For hand-picked short-staple cottons and for all roughly harvested cottons the two-stage method is usually sufficient, but the three-stage method is to be recommended for hand-picked long-staple cottons.

Gin saws handling roughly harvested cotton require more frequent sharpening than those handling clean-picked cotton, and increase in percentage of damp or wet cotton for either method of harvesting increases the damage to the saw teeth and the frequency with which they must be reconditioned.

Care should be exercised to obtain the proper saw, rib, and roll-box relationship. This precaution requires more elaborate adjustments when saws decrease in diameter from wear and numerous sharpenings than when new.

The best method of keeping gin saws in proper condition and protecting them from rust during the idle season is to cover them with a coat of suitable oil, which can be easily removed at the beginning of the next ginning season.

Gin ribs require periodic attention in order to preserve the essential relations with the saws that contribute to smooth and satisfactory ginning. The saws should revolve in a central position between each pair of ribs, or with a space equal to a saw thickness on each side, to prevent dragging of the teeth against the ribs and the consequent adverse effects on both cotton and saws.

Worn ribs may be replaced by new ones or repaired by various methods. These repairs consist of welding new materials upon the worn spots to build up the ribs, followed by grinding to correct dimension and shape; or covering the worn surfaces with hardened plates of suitable width and minimum thickness to once more give well-defined edges to the ribs. A smooth polish on the ribs contributes to good ginning, and can be preserved from season to season by coating with oil.

For 264 teeth per 12-inch saw, teeth with straight backs are recommended, while for 280 to 300 teeth per 12-inch saw, teeth with modified roach backs are preferable.

The reductions made in saw diameter of $\frac{1}{16}$ inch by wear and sharpening caused appreciable losses in lint turn-out in spite of the readjustments made in breast and saw positions. Losses in ginning capacity can be appreciable unless the pitch angle of the teeth is gradually increased without weakening the teeth during periodic sharpenings made of gin saws. Roached teeth give less lint turn-out than straight teeth when new; but when the saws are reduced in diameter by several sharpenings which cause the teeth to assume a straighter back, they do not show as much loss in turn-out as that produced by straight teeth similarly sharpened.

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